

REMARKS

The Office Action dated February 19, 2004, has been received and reviewed.

Claims 1-9, 11, 13-18, and 21-28 were previously pending and under consideration in the above-referenced application. Each of these claims stands rejected.

Claims 3-5, 7, and 27 have been canceled without prejudice or disclaimer.

New claims 29-35 have been added.

Reconsideration of the above-referenced application is respectfully requested.

Preliminary Amendment

Please note that a Preliminary Amendment was filed in the above-referenced application on November 7, 2003, but that the undersigned attorney has not yet received any acknowledgement that the Preliminary Amendment has been entered into the Office file for the above-referenced application. If, for some reason, the Preliminary Amendment has not yet been entered into the Office file, the undersigned attorney would be happy to provide the Office with a true copy thereof.

Rejections Under 35 U.S.C. § 102(b)

Claims 1-9, 11, 13-18, and 21-28 stand rejected under 35 U.S.C. § 102(b) for being directed to subject matter which is purportedly anticipated by the disclosure of U.S. Patent 5,592,736 to Akram et al. (hereinafter "Akram").

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single reference which qualifies as prior art under 35 U.S.C. § 102. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

In pertinent part, the disclosure of Akram is drawn to a method for forming a contact interface that will pierce the bond pads of a semiconductor device during testing or burn-in processing. First, a series of sharpened projections are formed in a silicon substrate. Figures 1-5E; col. 5, line 4, to col. 6, line 44. Next, a dielectric layer 64 is formed over the

sharpened projections. Figure 7; col. 7, lines 11-18. Thereafter, one or more conductive layers 66, 66A, 66B are formed over the dielectric layer 64. Figures 8, 8A, and 8B, respectively; col. 7, line 19, to col. 8, line 47.

A first of the three options for forming a conductive layer 66 over the dielectric layer 64 is illustrated in Figure 8 and includes a formation of a single layer of metal or conductively doped polysilicon. Col. 7, lines 20-31.

A second option for forming a conductive layer 66A is shown in Figure 8A and includes forming a first sublayer, or bonding layer 70 on the dielectric layer 64, and a second sublayer, or barrier layer 68, on the bonding layer 70. Col. 7, lines 32-50. The barrier layer 68 “is preferably a metal that will not easily form a ‘permanent’ or ‘chemical’ bond with a raised metal contact location on [a] die.” Col. 7, lines 42-46. While Akram discloses that the barrier layer 68 may be formed from titanium nitride, among other alloys (*see, id.*), Akram does not expressly or inherently describe that the barrier layer 68 may be formed adjacent to a dielectric layer or that it may be used in a contact that comprises a metal silicide.

A third option for forming a conductive layer 66B is depicted in Figure 8B and includes forming a silicon containing layer 76 over the dielectric layer 64 and a metal layer 78 over the silicon containing layer 76. Col. 7, lines 60-65. These layers 76 and 78 are then annealed to form a metal silicide layer 78A. *Id.*; col. 7, line 66, to col. 8, line 47. Akram discloses that such annealing is effected at a temperature of about 650°C to 820°C.

Independent claim 1 is directed to a method for forming a contact interface. The method of independent claim 1 includes providing a substrate with at least one contact that comprises semiconductor material protruding from the substrate. A layer that comprises dielectric material is formed over the at least one contact. A silicide contact is then formed over the at least one contact, including the dielectric material thereover.

As amended and presented herein, independent claim 1 recites that the metal silicide layer is formed by forming a layer that comprises silicon over the layer comprising dielectric material, forming another layer comprising dielectric material over the layer comprising silicon, and forming a layer comprising barrier material over the another layer comprising dielectric material. A selected region of the layer comprising silicon is then exposed through the layer comprising

barrier material and the another layer comprising dielectric material. Thereafter, a layer comprising electrically conductive silicidable material is formed over the layer comprising barrier material and in contact with an exposed region of the layer comprising silicon. The layer comprising electrically conductive silicidable material and the layer that comprises silicon are then annealed to form the silicide contact.

As the subject matter to which amended independent claim 1 is directed includes a process for forming a silicide contact, the only portions of the description of Akram that are relevant to the patentability of amended independent claim 1 are those that relate to the formation of silicide contacts.

That being said, Akram does not expressly or inherently describe that a silicide contact may be formed by forming layers of dielectric material and barrier material between the silicon containing layer 76 and the metal layer 78 thereof. Akram, therefore, also lacks any express or inherent description of exposing any portion of the silicon containing layer 76 through a layer that comprises dielectric material or a layer that comprises barrier material.

It is, therefore, respectfully submitted that Akram does not anticipate each and every element of amended independent claim 1, as would be required to maintain the 35 U.S.C. § 102(b) rejection of independent claim 1.

Claims 3-5, 7, and 27 have been canceled without prejudice or disclaimer, rendering the rejections thereof moot.

Claims 2, 6, 8, 9, 11, 13-18, 21-26, and 28 are each allowable, among other reasons, for depending either directly or indirectly from claim 1, which is allowable.

Claim 6 is additionally allowable because Akram lacks any express or inherent description of forming a layer comprising at least one of titanium nitride, tungsten nitride, tungsten silicon nitride, and titanium silicon nitride over a layer comprising silicon.

Claim 8 is further allowable since Akram does not expressly or inherently describe depositing TEOS over the silicon containing layer 76 thereof.

Claim 9 is also allowable since Akram includes no express or inherently description of depositing silicon dioxide over the silicon containing layer 76 thereof.

Claim 14 is further allowable because Akram neither expressly nor inherently describes that the materials of the silicon containing layer 76 and the metal layer 78 thereof may be annealed at a temperature of about 450° C to about 600° C. Instead, the disclosure of Akram is limited to annealing the materials of layers 76 and 78 at temperature of about 650° C to 820° C. Col. 8, lines 12-16.

Claim 18 is additionally allowable since Akram lacks any express or inherent description of removing an unreacted portion of the metal layer 78 thereof with a hydrochloric acid/peroxide mixture. Rather, the disclosure of Akram is limited to use of a H₂SO₄/H₂O₂ mixture of with dry etchant species such as Cl₂ or BCL₃. Col. 8, lines 25-32.

Claim 21 is also allowable because Akram does not expressly or inherently describe removing a layer comprising barrier material following the formation of a silicide contact.

Claim 22, which depends from claim 21, is also allowable since Akram lacks any express or inherent description that a layer comprising barrier material may be effected without substantially removing a silicide contact.

Claim 23 depends from claim 22 and is further allowable because Akram includes no express or inherent description of removing a layer comprising barrier material without substantially removing a layer comprising dielectric material.

Claim 24, which depends from claim 21, is additionally allowable because Akram does not expressly or inherently describe substantially completely removing barrier material.

Claim 25 also depends from claim 21 and is further allowable since Akram neither expressly nor inherently describes use of an ammonia/peroxide mixture to remove a barrier material.

Claim 26 is further allowable because Akram does not expressly or inherently describe that a layer comprising dielectric material may be located between the silicon containing layer 76 and the metal layer 78 thereof, or that a layer that comprises barrier material may prevent the metal of metal layer 78 from reacting with silicon of the silicon containing layer 76 through a void or imperfection in such an intervening dielectric layer.

For these reasons, it is respectfully requested that the 35 U.S.C. § 102(b) rejections of claims 1, 2, 6, 8, 9, 11, 13-18, 21-26, and 28 be withdrawn.

New Claims

Claims 29-35 have been added.

New claim 29 is an independent claim which recites a method for forming a contact interface with at least one contact that is configured to be received by a recess of a contact pad of a semiconductor device. As the sharpened projections of Akram are not configured to be received by a contact pad but, rather, to pierce a contact pad, it is respectfully submitted that Akram does not expressly or inherently describe, or anticipate, each and every element of new independent claim 29.

New claims 30-35 depend directly or indirectly from new independent claim 29.

It is respectfully submitted that none of new claims 29-35 introduces new matter into the above-referenced application.

It is respectfully requested that new claims 29-35 be allowed.

CONCLUSION

It is respectfully submitted that each of claims 1, 2, 6, 8, 9, 11, 13-18, 21-26, and 28-35 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



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BGP/dlm:rmh

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

Document in ProLaw

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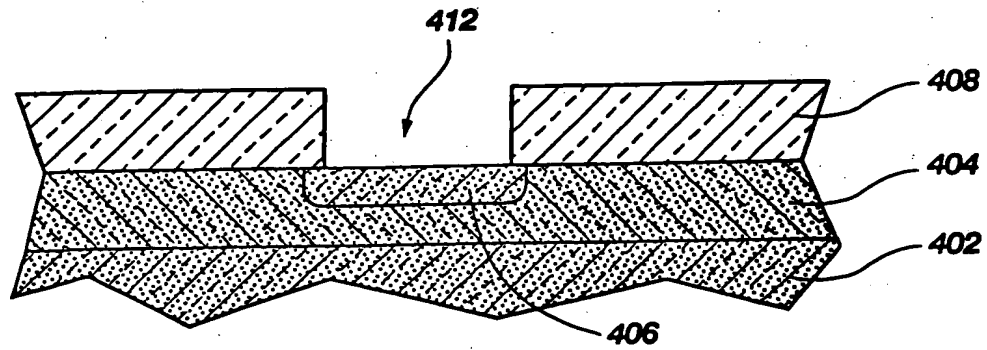


Fig. 28
(PRIOR ART)

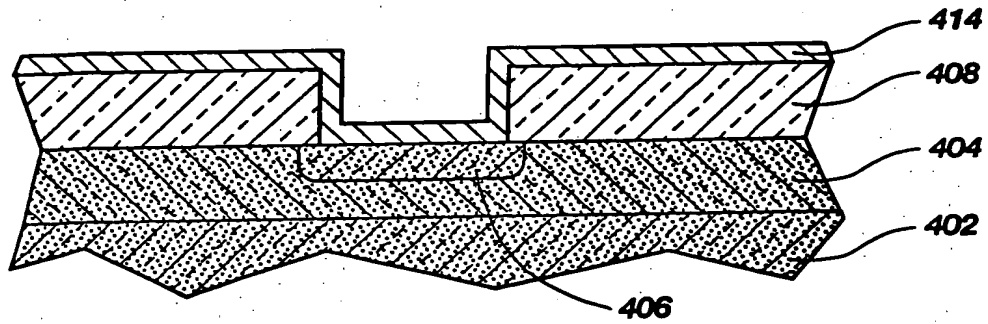


Fig. 29
(PRIOR ART)

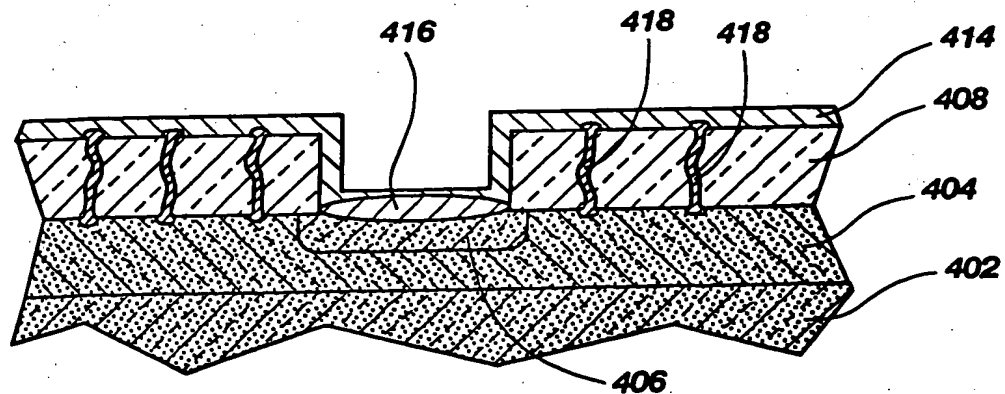


Fig. 30
(PRIOR ART)

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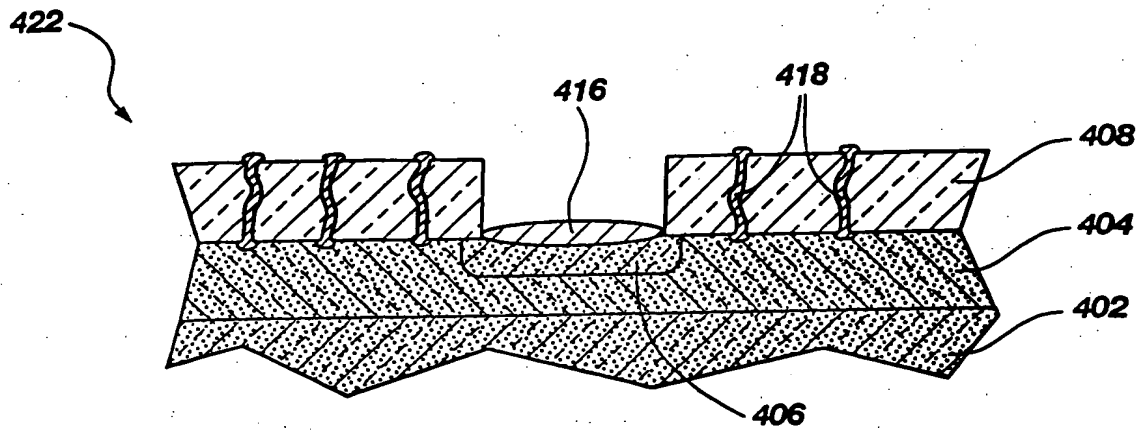


Fig. 31
(PRIOR ART)

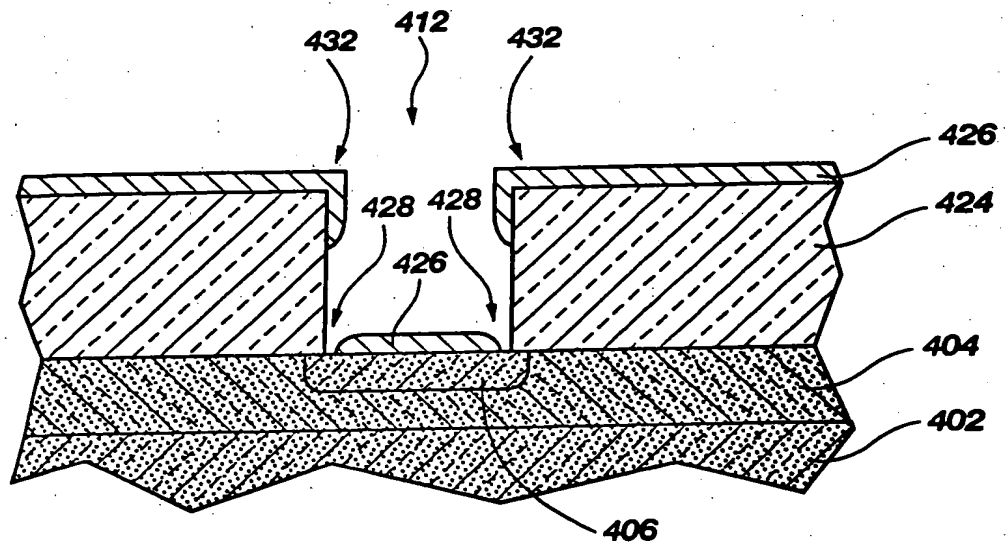


Fig. 32
(PRIOR ART)